

**REPORT ON STUDIES ON SEA TROUT AND BROWN TROUT RECRUITMENT IN A
STREAM IN MID-WALES. REPORT FOR THE YEAR ENDING MARCH 1998**

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1. INTRODUCTION

The study began with the primary aim of establishing a baseline as the "before" element of a "before and after" study of the effects of coniferous afforestation upon the trout population. The Afon Cwm was a particularly useful site because its small size rendered it suitable for quantitative electrofishing, detailed studies of water quantity and quality were being conducted by the NERC Institutes of Hydrology (IH) and Terrestrial Ecology (ITE) and good meteorological data were available from the nearby Clywedog Reservoir. Existing data suggested that the Afon Cwm was likely to suffer acidification when the canopy closed. It was, therefore, desirable to continue the run of trout census data.

2. OBJECTIVES OF THE STUDY

The objectives can be briefly summarised as:

Continue the electrofishing census of trout in the Afon Cwm, for a further 5 years, together with continuation of water temperature records. Information on water quantity and quality will be obtained from the NERC Institute of Hydrology.

Set up and run an automatic fish counter in the Afon Cwm. Keep a full account of technical details, of problems encountered and of appropriate solutions. Draft brief guidelines for operation.

Explore relationships between trout recruitment, fish counter data (using also additional information on migratory trout spawners) and discharge patterns during the spawning and incubation periods. Consider the possibilities for more elaborate and rigorous future developments.

3. ELECTROFISHING CENSUS WITH PARTICULAR REFERENCE TO RECRUITMENT

3.1 Methods

Electrofishing surveys of the trout populations were carried out at the nine permanently marked stations upstream of the IH gauging station in April and September 1997. Station 2 and Station 4 were electrofished twice and population estimates with 95% confidence limits calculated for these two stations. The remaining stations were each fished a single time and fishing efficiency, estimated at Stations 2 and 4, applied to the data. The estimated population of the whole stream was then calculated by assuming that each station was representative, in terms of stream width and fish population, of the length of stream which included that station and extended to points midway between that station and the stations immediately upstream and downstream. By using the 95% confidence interval value for the fishing efficiency estimate (p) an estimate was also calculated for the 95% confidence limits of the stream population as a whole. Trout were stratified into 0-group and >0-group categories for all the above estimates.

3.2 Results

The 0-group trout were too small for quantitative enumeration in April. Numbers in September showed an increase over those of 1996 and resulted in a population estimate of 1768 trout. This compares with a mean value of 1124 (1984-1996) and a maximum of 3122 in 1995. It was the second highest estimate since 1989.

In April numbers of >0-group fish were the highest recorded since 1992 with an estimate of 1346 and reversed the trend of decline observed in numbers since 1989. Numbers of >0-group in September (population estimate 987) were slightly below the levels found in 1996 but still the second highest since 1991.

4. SPAWNER SURVEYS

4.1 Methods

Two electrofishing surveys were carried out on the Cwm before and during the period when the trout spawn. In the first (on 22 October) all fish of over approximately 12 cm were caught. These were measured and categorised into immature, ripe male or ripe female categories. In the second survey (20 November) only the (larger) migratory fish were caught, measured and sexed. In both surveys fish over 20 cm had scales removed for age determination.

4.2 Results

4.2.1 Number of resident female spawners and estimated egg input

Only one resident female was caught in the spawner surveys and based on this, the egg input was estimated at 110. The egg input estimate, based on the length - fecundity relationship and the number of resident trout >12.5 cm (age 2 + and older) caught in the September survey was 1210.

4.2.2 Migratory fish sizes

Male migratory fish ranged in size from 21.4 cm to 42.1 cm. Females, however, were all ≥ 30 cm in length, ranging from 30.0 cm to 46.1 cm (mean 36.7 ± 4.0 cm). This mean is lower than the average over the period 1994-1997 (42.1 ± 3.6 cm).

4.2.3 Sex ratios of migratory trout

A total of 10 fish >20 cm were caught in the first spawning period electrofishing survey carried out on 22 October. Six fish between 20 and 30 cm were all males and the four fish >30 cm comprised two males and two females.

In the second spawning period electric fishing survey carried out on 20 November a total of 11 fish (all >30 cm) were caught of which 7 were female and 4 male.

4.2.4 Egg production by migratory trout

The minimum egg input by migratory trout was estimated at 14408. This is based on the sub-sample caught in the spawner surveys.

4.2.5 Fish ages

Scales were taken from all trout >20 cm caught in the spawner surveys. These were examined to both age the fish and ascertain whether they were anadromous sea trout or potomodromous brown trout. 21 fish were examined of which only 2 were brown trout (had not migrated out to sea). All the rest showed clear signs of sea growth on the scales (Table 1). Three of the fish showed spawning marks on the scales indicating that they were returning for a second time and the rest appeared to be maiden spawners.

Table 1 Length and age of fish caught in the Afon Cwm in the 1997 surveys						
Date	Length (cm)	Sex	Condition	Age	Total age	Comments
22/04/97	13.0			2+	2+	Pre-smolt
22/04/97	14.5			1++/2	2	Pre-smolt
23/09/97	28.6	M		2+	2	Sea trout
22/10/97	21.7	M		3+	3+	Brown trout. Very centre of scale scarred.
22/10/97	22.2	M		2+	2+	Sea trout. ? Sea growth may be river growth
22/10/97	23.3	M		Sc.+	?	Sea trout
22/10/97	27.9	M		2+	2+	Sea trout
22/10/97	28.8	M		3+	3+	Brown trout
22/10/97	29.3	M		2+	2+	Sea trout
22/10/97	30.8	M	Running	2+	2+	Sea trout
22/10/97	34.0	F		Sc.+	?	Sea trout (?2.+)
22/10/97	42.1	M	Running	Sc.1+	?	Sea trout
22/10/97	46.1	F		Sc.+SM+	?	Sea trout
20/11/97	30.0	F	Spent	2+	2+	Sea trout
20/11/97	30.2	M		2+	2+	Sea trout
20/11/97	30.9	F		2+	2+	Sea trout
20/11/97	32.1	M		Sc.1+	?	Sea trout
20/11/97	32.2	F		Sc.+	?	Sea trout
20/11/97	35.7	F		Sc.1+	?	Sea trout
20/11/97	37.1	F	Spent	Sc.1+	?	Sea trout. Sc.+ very faint SW check
20/11/97	38.0	F		Sc. SM.+	?	Sea trout ? Age.
20/11/97	40.0	M		2.1+	3+	1yr Cwm, 1yr river, +sea
20/11/97	44.9	F	Part Spent	1.1SM+	3+	Sea trout
20/11/97	46.1	F	Ripe	Sc	?	Sea trout
30/11/97	41.8	M		2.1+	3+	Sea trout

5. FISH COUNTER DEVELOPMENT AND MANAGEMENT

5.1 Methods

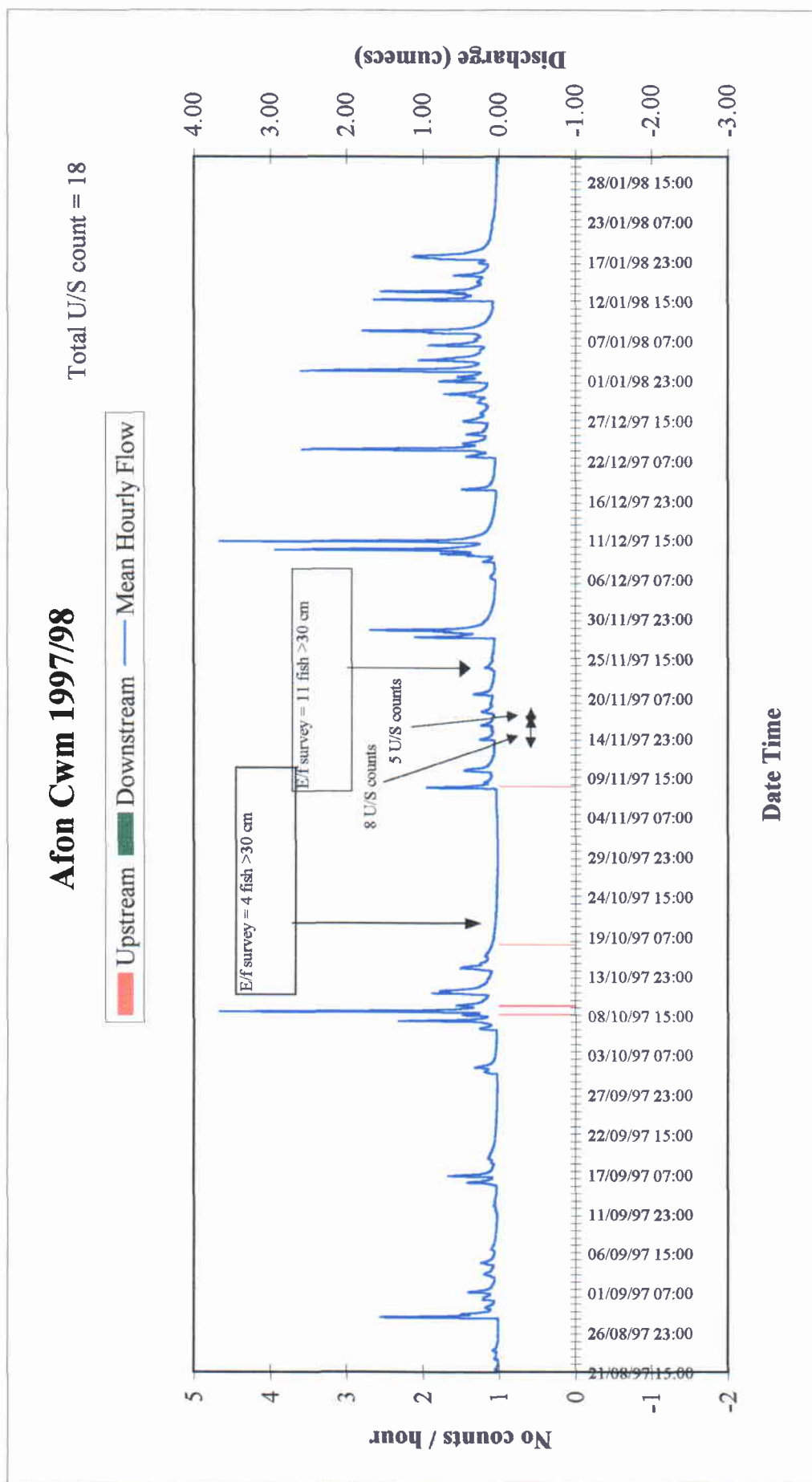
No significant problems were encountered in the running of the counter during the reporting year. The large capacity batteries, together with the charging by the wind generator, overcame the problems previously encountered with the batteries running down. The problems encountered last year, where test procedures failed to indicate a broken electrode connection, have been overcome by using a metal rod to simulate fish passage over the electrodes. A problem with the logger used to record the hourly counts did however occur. Between 13 November and 20 November the counter recorded a total of 13 upstream counts, the hourly times of these were not however recorded by the logger. The cause was an insecure connection between the logger and the counter. Problems still exist however in distinguishing between false counts and real counts. Under low flow and high wind conditions waves are created which can cause false counts. These wave created counts are presently edited from the data by not including any counts that occur during low flow periods.

An account of the installation, instrumentation and commissioning of the fish counter will be given in the final report. A simple checklist and guidelines for operation, based on experience in the Afon Cwm, will also be prepared.

5.2 Numbers of fish seen compared with the counter data

Electrofishing surveys, during the period of spawning immigration, resulted in the capture of 4 trout (>30 cm) on 22 October and a further 11 trout (>30 cm) on 22 November. Prior to the first electrofishing survey the counter had also registered a total of 4 fish ascending into the study area of the stream. In the period between the first and second survey a further 14 upstream counts were registered. As the recording of downstream counts was not logged, no nett figure can be given for the number of fish expected to be present in the survey section at the time of the second survey. The total counter number of 18 compares well, however, with the observed (captured) number of 15 (Fig 1).

Fig 1 Discharge and counter data from the Afon Cwm



6. ANCILLARY OBSERVATIONS

6.1 Water quantity and quality

These topics are being studied by the NERC Institute of Hydrology, the NERC Institute of Terrestrial Ecology and the NERC Institute of Freshwater Ecology. Information is freely available to the present project. The discharge graph is shown in Fig 1.

6.2 Water temperature

Water temperature has continued to be recorded in the main Afon Cwm at Nat. Grid ref. SH/916083, just upstream of Station 2 at an altitude of c. 282 m. O.D., from the main stream and from a tributary at Nat. Grid ref. SH/916089 (altitude c. 343 m) close to Station 7. The loggers record temperature at hourly intervals with an accuracy of $\pm 0.1^{\circ}\text{C}$.

Such data can be used to predict, approximately, the rate of trout egg incubation and the dates of median eyeing, hatching and swim-up. This can be useful, for example, in estimating the period during which intra-gravel stages are vulnerable to washout by spates.

6.3 Air temperature

A standard meteorological station is operated at Clywedog reservoir (Nat. Grid ref. SN/912870, altitude 345 m. O.D.) by staff of Severn Trent Water and the daily air temperature data are made available to the IFE.

7. REPORTS AND PUBLICATIONS

Welton, J.S., Crisp, D.T. & Beaumont, W.R.C. (1997). Mid-term report on sea trout and brown trout recruitment in a stream in mid-Wales. IFE Report to MAFF.

Crisp, D.T. (1997) Water temperature of Plynlimon streams. *Hydrology and Earth System Sciences*, 1, 535-540.

Crisp, D.T. & Beaumont, W.R.C. (1997) Fish populations in Plynlimon streams. *Hydrology and Earth System Sciences*, 1, 541-548.

8. ACKNOWLEDGMENTS

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